C L A I M S

1) Automatic installation for the acquisition of three-dimensional shapes and for taking measurements of subjects, particularly in the form of a booth adapted for human subjects, comprising at least one unit for projecting fringes, in particular light fringes, and at least one unit for rapidly taking views, as well as a control unit for the installation and for processing the acquired views, integrated or separate, characterized in that said units (4, 5) for projection and taking views are gathered in one or several acquisition head or heads (3) and in that said installation (1) also comprises, on the one hand, several markers or fixed reference points (7) and several reference projection surfaces (8) surrounding the zone (9) of acquiring and measuring receiving the subject (2) to be acquired and located in the field of vision of the unit or of each of the units (5) for taking views and, on the other hand, means (10) for generating a temporary light wall opposite said at least one acquisition head (3) or each of said acquisition heads (3) relative to the acquisition zone (9).

2) Installation according to claim 1, characterized in that the acquisition zone (9) consists in a substantially parallelepipedal volume, the markers (7) being disposed at known positions of the control and processing unit (6) along several lateral alignments in the direction of taking the view and in two parallel spaced planes (P, P') delimiting the upper and lower surfaces of said volume (9) and the reference projection surfaces (8), undeformed and preferably flat, consisting in vertical

scales connecting the two mentioned planes (P, P') at the level of four vertical edges of the acquisition zone (9), the information supplied by the markers (7) and the projection surfaces (8) on the different views being used by the unit (6) at each acquisition of a view and for standardizing the installation (1).

3) Installation according to any one of claims 1 and 2, characterized in that it comprises two acquisition heads (3) located in opposition on opposite sides of the acquisition zone (9), and that each of said heads (3) encloses in its field of vision all of the markers (7) and the projection surfaces (8) and in that with each of said heads (3) is associated a means (10) for generating a corresponding light wall, the arrangement of the markers (7) and/or the projection surfaces (8) permitting determining the upper and lower ends of the acquisition zone (9) and the orientation of this latter.

4) Installation according to any one of claims 1 and 2, characterized in that it comprises four acquisition heads (3) gathered in two pairs of heads located in opposition on opposite sides of the acquisition zone (9), and in that one head, located in a lower position, of each of the pairs of mentioned heads encloses in its field of projection and of vision a lower portion of the acquisition volume (9) and that the other head, located in an upper position, of each of said pairs of heads, encloses an upper portion of said volume (9), complementary to and partially overlapping the mentioned lower portion, said lower heads, respectively upper heads, enclosing, moreover, lower markers (7) respectively upper markers, and lower portions,

respectively upper portions, of the reference projection surfaces (8).

5) Installation according to any one of claims 1 and 2, characterized in that it comprises at least three acquisition heads (3), or at least three units (5) for taking views, disposed in a Y shape in the booth forming the installation (1).

6) Installation according to any one of claims 1 and 2, characterized in that it comprises at least four acquisition heads (3), or at least four units (5) for taking views, disposed in an X in the booth forming the installation (1).

7) Installation according to any one of claims 1 to 6, characterized in that the means (10) for generating a wall of light consist of electronic flashes whose triggering is synchronized with that of the unit or units (5) for taking views opposite it relative to the acquisition zone (9), this unit or units (5) consisting each of a digital video camera, for example of the CCD type.

8) Installation according to any one of claims 1 to 7, characterized in that the alternate black and white fringes are produced by the units (4) by means of electronic flashes associated with projection objectives without geometric deformation, for example of the aspherical type, and synchronized as to triggering with the units (5) for taking views of the corresponding acquisition heads (3), the black fringes having a width greater than that of the white fringes or luminous fringes, the ratio of the width

of the black fringes/white fringes being comprised between 1.1 and 1.5, preferably about 1.3.

9) Installation according to any one of claims 1 to 8, characterized in that each of the networks of projected horizontal fringes comprises at least two white fringes (FR1, FR2, FR3) mutually spaced apart, having widths substantially greater than those of the other fringes, preferably two or three times greater, and serving as reference fringes for referencing and identifying the other fringes.

10) Installation according to claim 9, characterized in that each of the networks of fringes comprises three reference fringes (FR1, FR2, FR3) disposed asymmetrically in the design of the network in question and/or with different mutual spacings, one of said reference fringes (FR1) being located for projection at about a third of the height of the volume formed by the acquisition zone (9) and at least one other (FR2) for projection at about two-thirds of the height of the volume formed by said zone (9).

11) Automatic process for substantially instantaneous acquisition of three-dimensional shapes and taking measurements of subjects, in particular humans, particularly by means of the installation according to any one of claims 1 to 4 and 7 to 10, characterized in that it consists essentially in placing or causing to be placed a subject (2) in an acquisition zone (9), located in a booth or the like, this subject (2) being disposed in a given posture and/or position and this zone (9) comprising markers (7) and reference projection surfaces (8), located

in the fields of vision of the acquisition heads (3) of views of said subject (2) and constituting permanent standardization references, for carrying out the acquisition of a so-called front view comprising, on the one hand, taking a first front image of the subject (2) by means of a first unit (5) for taking views, in synchronism with an illumination creating a wall of light behind the subject (2) by means of a first means (10) for generating a wall of light, for the acquisition of a first silhouette contour and, on the other hand, for taking a second front image of the subject (2) by means of said first unit (5) for taking images in synchronism with the projection of a network of horizontal fringes by means of a first projection unit (4) on the front surface of the subject (2), then carrying out the acquisition of a so-called rear view in a direction opposite the direction of the front view, said acquisition comprising, on the one hand, taking a first rear view image of the subject (2) by means of a second unit (5) for taking views in synchronism with illumination creating a wall of light in front of the subject (2) by means of a second means (10) for generating a wall of light, for the acquisition of a second silhouette contour, and, on the other hand, taking a second image of the back of the subject (2) by means of said second unit (5) for taking views in synchronism with the projection of a network of horizontal fringes by means of a second projection unit (4) on the rear surface of the subject (2) and, finally, processing, by means of a suitable control and processing unit (6), the images and views acquired by correlation and exploitation of the different information supplied by it for the construction of a three-dimensional representation of the subject (2), for the extraction of

measurements and/or for the classification of the subject (2) in one or more of predetermined categories.

12) Process according to claim 11, characterized in that the projected networks of fringes each comprise luminous reference fringes (FR1, FR2, FR3) distributed asymmetrically in the design of the network in question and having a width substantially greater than that of the other fringes and in that the taking of images is carried out in a sequential manner over an interval of total acquisition times sufficiently small to avoid the need to take into account possible movement of the subject (2).

13) Process according to any one of claims 11 and 12, characterized in that the operation of processing consists particularly in isolating surface images acquired by projection of fringes by means of corresponding images acquired in silhouette, then displaying and locating the fringes on the images by spatial filtration, by determining, analyzing and locating, and if desired extrapolating, the upper and lower ends of the gathered signal along a plurality of vertical lines, then identifying the different fringes, as the case may be after reconstruction from fragments of fringes, and particularly the reference fringes or fragments of fringes (FR1, FR2, FR3), counting these fringes or fragments of fringes and finally propagating the count to all the fringes contained in the isolated representations of the subject.

14) Process according to claim 13, characterized in that the identification of the fragments of fringes consists in establishing vertical adjacency relationships

between consecutive fragments in the vertical direction of the views and in quantifying these relationships, with identification or not of the fringes or fragments of real fringes, as a function of the length or size of overlap between two adjacent fragments, of the mean distance between two adjacent fragments, and of the respective colors of these latter.

15) Process according to any one of claims 13 and 14, characterized in that the propagation of the counting of the fringes, after identification and counting of the reference fringes (FR1, FR2, FR3), consists in defining search paths beginning at the top of each representation of the subject (2) on the surface images in the form of isolated fringe images and extending downwardly and/or along the sides to the ends of the different ramifications of the representation of the subject (2).

16) Process according to any one of claims 11 and 13, characterized in that the construction of the three-dimensional representation consists, after identification and numbering on the isolated surface images acquired by projection of fringes in front and rear views, in generating representations, in the form of stacks of slices, of different separate and complementary zones of the subject (2), zones determined by means of characteristic points located on the contours obtained from silhouette views, in assembling together, for each of the mentioned separate zones, the two corresponding half shells representing the front and rear views, in the form of stacks of slices, the given zone of the subject (2) and, finally, in reconstituting a total three-dimensional

volumetric representation by assembling the stacks of slices representing the different separate zones of the subject (2).

17) Process according to any one of claims 11 to 16, characterized in that it consists in carrying out, in the course of each acquisition of a view, a step of automatic standardization on the basis of information supplied by the markers (7) and the reference projection surfaces (8) on the different images collected and used by the unit (6).

18) Process according to any one of claims 11 to 17, characterized in that it also consists in carrying out, as the case may be after rotation of the subject (2) by 90° about a vertical axis, the taking of a profile view by means of a view-taking unit (3) triggered in synchronism with a means (10) for generating a corresponding opposite wall of light, so as to acquire the contour of the silhouette of the subject (2) in profile view.